

## DRIVE APPARATUS FOR FRAME DEFLECTION AND METHOD

The present invention relates to deflection compensation, e.g. in Cathode Ray Tube (CRT) devices, e.g. monitors or televisions, and more particularly to a device and method for correcting various forms of deflection including rotation, trapezoidal and parallelogram deflection.

5 A CRT device forms an image using an electron beam focused on a fluorescent screen by electromagnetic deflection. The deflection is accomplished by applying current of sawtooth waveforms to horizontal and vertical coils.

10 A typical monitor is used as a peripheral device for a computer that provides video signals and horizontal and vertical sync signals necessary for forming an image at the monitor. An electron gun forms an electron beam according to the video signals. The 15 electron beam is deflected in accordance with the horizontal and vertical sync signals horizontally and vertically by the horizontal and vertical coils on the fluorescent screen in front, thus representing a specified picture

15 The earth magnetic field influences deflection of electron beam by the horizontal and vertical deflecting coils, thus the picture is displayed on the screen in a monitor on the tilt to left or right. An additional coil is utilized in the prior art to complement for the tilt of the picture displayed by creating a complementing magnetic field. Such additional coil may be placed on the funnel portion of the tube used in the CRT device and the generated 20 complementing magnetic field moves the tilt of the picture on the screen clockwise or counterclockwise, and the degree of tilt complement is variable.

25 However, the magnetic field created by the complementing coil may disadvantageously affect the quality of picture. Additionally, this implementation involves a problem that a special complement coil is required. Other prior art devices to correct for distortion are disclosed in U.S. Patent No.5,953,081, U.S. Patent No.5,686,800 and JP patent Publication 07-107503. Patent document US 5,953,081, incorporated herein by reference, discloses a system for correcting the tilt of a displayed picture due in part to the Earth magnetic field. In this document, the tilt of the picture can be controlled by controlling the tilts of the horizontal and vertical sawtooth waves applied to the horizontal and vertical coils respectively. Essentially horizontal and vertical parallelograms are 30 simultaneously controlled by synthesizing the horizontal and vertical sawtooth waves, after controlling their amplitudes and phases with vertical and horizontal position control signals, respectively before sending them to a vertical output unit and a horizontal oscillation unit

thereby changing the tilt of the picture. In such implementation two respective sawtooth signals are applied to the respective horizontal and vertical coils. However the same sawtooth signal is applied to each of the two coils. Thus both halves of the horizontal and vertical coils are driven in series.

5 It is an object of the present invention to provide a novel apparatus and method that overcomes one or more limitations of the prior art hereinabove enumerated.

According to the present invention, a frame drive circuit for a device having a deflection processor which develops a deflection processor output signal includes a frame coil having a first core half and a second core half, and a first driver and a second driver.

10 The deflection processor output signal is applied to each of the first driver and the second driver. Each of the first driver and the second driver are selectively operative independently of each other to develop respectively a first coil drive signal and a second coil drive signal as a function of the deflection processor output signal. The first coil drive signal and the second coil drive signal are applied to a respective one of the first coil half and said second coil half.

15 A feature of the present invention is that the existing frame coil such as the horizontal coil or the vertical coil, is split into separate core halves with each core half being separately driven, instead of in series as in the prior art. An advantage of the separate driving of the core halves is that greater design freedom is allowed, and correction of  
20 distortion may be accomplished without additional hardware, such as that disclosed in the prior art references.

These and other objects, advantages and features of the present invention will become readily apparent to those skilled in the art from a study of the following Description of the Exemplary Preferred Embodiments when read in conjunction with the attached  
25 Drawing and appended Claims.

Fig. 1 is a schematic diagram of a frame drive circuit constructed according to the principles of the present invention.

Fig. 2 is a representation of rotation correction accomplished by the present invention.

30 Fig. 3 is a representation of parallelogram correction accomplished by the present invention.

Fig. 4 is a representation of trapezoidal correction accomplished by the present invention.

Referring now to Fig.1, there is shown a frame drive circuit 10 for a CRT device such as a CRT monitor or a CRT television set and the drive circuit 10 includes a deflection processor 14 and a frame coil 16. According to the present invention, the frame drive circuit 10 includes a first core half 12 and a second core half 18 of the frame coil 16 and a 5 first coil driver 20 and a second coil driver 22.

The deflection processor 14 develops, as is well known, a deflection processor output signal. The deflection processor output signal is applied to each of the first driver 20 and the second driver 22. Each of the first driver 20 and the second driver 22 are selectively operative independently of each other to develop respectively a first coil drive signal and a 10 second coil drive signal as a function of the deflection processor output signal. The first coil drive signal and the second coil drive signal are in turn applied to a respective one of the first coil half 12 and the second coil half 18. As will be shown hereinafter, the two coil signals may differ in amplitude and one may be DC shifted relative to the other. The 15 inventor has realized that applying different current to the two coils enables correcting the tilting of the picture without the need of an extra rotation coil used in some high-end CRT display system. The current difference enables correcting trapezoidal, rotational and parallelogram tilt of the picture. The adjustment of the respective coil currents may be effected at the time of manufacture of the display through testing or directly by the user during a tilt correction set up.

20 In one embodiment of the present invention, each of the first driver 20 and the second driver 22 amplify the deflection processor output signal to develop each respective one of the first coil drive signal and the second coil drive signal. In this embodiment, the amplification of the deflection processor output signal may be selected such that the resultant one of the first coil drive signal and the second coil drive signal when applied to the first coil half 12 and the second coil half 18, respectively, are operative to correct 25 rotation of an image of the CRT monitor, as best seen in Fig.2.

In this embodiment the amplification of the deflection processor output signal by each of the first driver 20 and the second driver 22 may be substantially equal if the rotation of the CRT image is caused by a constant ambient field, such as the magnetic field of the 30 earth. Furthermore, the ratio of the amplification of the deflection processor output signal may also be selectively adjusted to provide for trapezoidal correction, as best seen in Fig.4.

In another embodiment of the present invention, each of the first driver 20 and the second driver 22 further DC shift the deflection processor output signal to develop each

respective one of the first coil drive signal and the second coil drive signal. In this embodiment, the DC level shift of the deflection processor output signal may be selected such that the resultant one of the first coil drive signal and the second coil drive signal when applied to the first coil half 12 and the second coil half 18, respectively, are operative to 5 parallelogram distortion of an image of the CRT monitor, as best seen in Fig.3.

It is contemplated by the present invention that the amplification of the deflection processor output signal, whether independently, in lockstep or in ratio, as well as the DC level shift, may all be utilized, alone or in any combination, in practicing the present invention. Usually, a CRT image will exhibit several forms of distortion, and correction of 10 such distortion is accomplished by separate user settings for each type of distortion, as in the prior art. The present invention allows for the simplified apparatus to correct for several types of distortion simultaneously.

Accordingly each of the first driver 20 and the second driver 22 include an amplifier 24, 26 having an input 24\_IN, 26\_IN and an output 24\_OUT, 26\_OUT. The input 24\_IN, 15 26\_IN of each amplifier 24, 26 is adapted to receive the deflection processor output signal. The output 24\_OUT, 26\_OUT of each amplifier 24, 26 develops an amplified signal for application to a respective one of the first coil half 12 and the second coil half 18.

Each of the first driver 20 and the second driver 22 may further include a DC level shifter 28, 30 having respective inputs 28\_IN, 30\_IN and respective outputs 28\_OUT, 20 30\_OUT. The input 28\_IN, 30\_IN of each DC level shifter 28, 30 is adapted to receive the deflection processor output signal from the deflection processor 14. The output 28\_OUT, 30\_OUT of each DC level shifter 28, 30 develops a DC level shifted signal for application to a respective one of the first coil half 12 and the second coil half 18. The amplifier 24, 26 and the DC level shifter 28, 30 of each driver 20, 22 may be separate components connected 25 in series or a single circuit, as seen in Fig. 1, that provides both functions.

There has been described hereinabove a novel frame drive circuit constructed according to the principles of the present invention. Those skilled in the art may now make numerous uses of, and departures from, the above-described embodiments without departing from the inventive concepts disclosed herein. Accordingly, the present invention 30 is to be described solely by the lawfully permitted scope of the appended Claims.